CanonieEnvironmental

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July 14, 1988

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Mr. Roger J. Crawford
Corporate Director of Environmental Control
Outboard Marine Corporation
100 Seahorse Drive
Waukegan, IL 60085

Transmittal
Full-Scale Test Run
Taciuk Processor

Dear Roger:

We are enclosing two copies of the full-scale test runs completed on the Taciuk processor in Calgary, Canada on April 19 and May 12, 1988. The results indicate that the processor separates the PCBs and oil from the solids with the treated soils showing less than 0.1 ppm polychlorinated biphenyls (PCBs). The results also indicate that no dioxins were generated as a result of processing and that some dibenzofurans present in the PCBs used for the test were found along with PCB in the flue gas from the processor.

Canonie Environmental Services Corp. believes that the data indicates no degradation of PCB into dioxin as a result of processing and is confident that a full-scale transportable unit will have as good or better performance than measured in the full-scale demonstration. Based on the success of the full-scale demonstration, Soiltech, Inc. a 50/50 joint venture between Canonie and UMATAC is going forward with the construction of a transportable Taciuk processor for application to PCBs and other oil residue remediation.

I trust that you will share our views of the test results and that we may have the opportunity to further discuss the use of the Soiltech Taciuk Processor for the OMC project. If you have any questions on the report, please call Mr. Peter Romzick or me.

Very truly yours,

Timothy J. Harrington

Timothy J. Harrington
Vice President - Midwest

TJH/pr

Enclosures

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TRADE SECRET

TREATMENT OF SOILS CONTAINING PCBS
RESULTS OF TEST RUNS

TRADE SECRET

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

TREATMENT OF SOILS CONTAINING PCBS
RESULTS OF TEST RUNS

1.0 INTRODUCTION

Over the last 10 years, the Alberta Oil Sands Technology and Research Authority (AOSTRA) has developed a continuous anaerobic thermal process (ATP) for the recovery of oil from soils. The process was invented by William Taciuk of UMATAC Industrial Processes (UMATAC) in Calgary, Alberta, Canada. Waste treatment application of the process in the United States is available through Soiltech, Inc.

In December, 1987, a series of bench tests were run to evaluate the ability of the Taciuk processor to remove polychlorinated biphenyls (PCBs) from contaminated sand and sludge. The test results indicated PCBs were removed from the solids to below detection limits, with no apparent decomposition of PCBs into polychlorinated dibenzofurans (furans) or polychlorinated dibenzodioxins (dioxins).

The processor technology was evaluated further by conducting full-scale demonstrations of the process in the five-ton-per-hour (TPH) process demonstration unit (PDU) located at the testing facilities of UMATAC in Calgary, Alberta. The tests were conducted on oil sands "spiked" with Aroclor 1242.

Two full-scale process demonstrations were made at the UMATAC testing facility. The oily sand was provided by UMATAC and the PCBs (Aroclor 1242) was provided by the Alberta Waste Management Corporation. The objective of the full-scale test runs was to verify that the processor will extract and recover PCBs from soils without creating furans or dioxins.

This report presents the results of the two full-scale process demonstrations.

2.0 SUMMARY OF RESULTS

In the two-hour test (Test 1) and four-hour test (Test 2) runs, PCBs were stripped from feed soils with initial concentrations of 0.7 and 1.5 percent PCBs by weight (Aroclor 1242) to non-detectable levels [detection limit of 0.1 parts per million (ppm)]. The treated soil concentration was confirmed by independent analyses from two laboratories.

Low levels of PCBs were detected in the processor flue gas. The flue gas stream is the primary emissions source from the process. After Test 1, it was theorized that the PCBs in the flue gas may be originating from leaks between the preheat and the combustion zones of the PDU. Repair work on the leaks was conducted after Test 1 and succeeded in reducing the PCBs to the flue gas train by 86 percent.

The addition of a wet scubber to the discharge end of the flue gas processing train for Test 2 increased the flue gas cleaning efficiency by a factor of four. The commercial unit will include a more effective wet scrubber and a gas phase activated carbon adsorption system in the flue gas processing train to eliminate the flue gas contaminants.

The results of the test runs indicate that the PCBs do not decompose to furans and dioxins. EPA Modified Method 5 (MM5) sampling trains were used to sample the flue gas for furans and dioxins. Furans were detected in the flue gas but were found to have originated from furans in the PCB feed oil. Dioxins were not detected in the flue gas or PCB feed oil.

A health and safety and air monitoring program was prepared and implemented during the pilot test runs. The plant operators were trained in the use of Level C safety equipment and air monitoring devices were placed at various locations around the process equipment. The monitoring results ranged from non-detectable to 14 micrograms per cubic meter PCB. The highest concentration was approximately two orders of magnitude below the allowable limit for employee exposure.

3.0 PILOT PLANT RUNS

The full-scale test runs were made in the five TPH PDU located at UMATAC's testing facility in Calgary, Alberta. Test 1 was a 2-hour run during which 126 pounds of PCB oil was fed to the processor. Processor products were collected for a period of 2.5 hours during Test 1. Test 2 was a 4-hour run during which 469 pounds of PCB oil was fed to the processor. Processor products were collected for a period of 4.5 hours during Test 2. The processor systems were operated in much the same fashion as normally used for oil sands or oil shale operations.

3.1 Test Objectives

The objective of the full-scale test runs was to demonstrate the ability of the Taciuk process to remove PCBs from feed soils without creating furans and dioxins.

3.2 Description of PDU

Figure 1 is a schematic diagram of the PDU used for the full-scale test runs. The PDU has a nominal capacity of three to five TPH, depending on the characteristics of the feed material. Commercial units will operate between 5 and 20 TPH.

The thermal processing unit resembles a rotating kiln. It contains four separate internal sections; pre-heat, retort, combustion, and cooling. The feed enters through the pre-heat section, passes through a seal to the retort section, passes through another seal to the combustion chamber, and is cooled by thermal conduction prior to discharge. The pre-heat section operates at a temperature sufficient to vaporize relatively low boiling point materials such as water and light oils. The retort section operates at a temperature sufficient to vaporize heavy oil and PCBs. The seals at both ends of the retort section maintain a near oxygen-free environment and prevent the oxidation of the hydrocarbons at the elevated temperatures in

the retort section. The combustion section is fired with natural gas to meet the heat requirements for the thermal processing unit. Depending on the feed material, residual carbon (coke) on the soils leaving the retort section is a source of heat input. If the amount of coke is high enough, the heat requirements through the process can be totally provided by burning coke. A portion of the hot sand in the combustion zone is recycled back through the retort section via a sealed passageway. The remaining soils in the combustion section are lifted and distributed onto the exterior of the pre-heat section to provide conductive heat transfer. The heat transfer removes heat from the discharging soils and provides heat to the incoming soils.

3.2.1 Feed Systems and Feed Preparation

The PDU is fed through a series of bins equipped with weigh feeders. These bins deposit sand onto a conveyor belt which transports the feed to the pre-heat section of the kiln. Oversize material is removed by an internal screening system located in the pre-heat section of the kiln.

Pumpable sludges and other liquids can be added directly to the pre-heat zone of the kiln or sludges and sand can be mixed prior to adding the material to the preheat section of the PDU, provided the mixture does not become sticky and difficult to feed through the weigh feeder system. PCBs were pumped directly to the pre-heat zone during the full-scale test runs.

3.2.2 Product Collection Systems

The PDU product collection points are identified on Figure 1. The primary products include sand discharge, oils, water, and flue gas which, following scrubbing, is discharged to the atmosphere.

3.2.3 Pre-heat Water Collection Systems

The low temperature steam and any light oil products from the pre-heat section of the PDU are normally condensed in a cooling tower equipped with

disk and donut packing. Cooling water is flushed counter-current to the incoming gas stream. The resulting water and light oil product is separated in an oil and water separation tank. Light oil can be skimmed from this tank and stored separately or blended with the primary oil product. The water is stored and sampled prior to disposal. Non-condensable gases from the cooling tower pass through a knock-out drum to remove any residual moisture before venting to atmosphere. During the full-scale test runs, the pre-heat vapor stream was sent to the oil recovery system to minimize the number of discharge streams from the processor.

3.2.4 Oil Recovery System

The vapor stream from the reaction zone passes through two stages of hot cyclones to remove entrained dust and fines. The cyclones remove fine dust prior to condensing the PCBs, oil, and other condensable products. The heavier oil vapors are then condensed in a fractionating tower. Following the fractionating tower, light oils and water are condensed in the overhead condenser and separated in an oil/water separator. The non-condensable gases are sent to a flaring stack.

Side draw and bottoms oils collected in the middle and bottom portions of the fractionation tower are collected and stored.

The light oil product condensed in the overhead condenser is collected and pumped to storage. The majority of the side draw oil and a portion of the overhead oil is used to flush the fractionating tower at the end of a run and dilute the bottoms oil to maintain pumpability at ambient temperature. Water product obtained from the overhead condensor is stored.

3.2.5 Tailings Handling System

All tailings exiting the cooling zone are cooled by water addition then transported to an outside storage pile via screw and belt conveyors.

3.2.6 Flue Gas Handling and Cleaning System

Coke formed on the solids from the reaction zone is partly or totally combusted to provide the heat requirements of the process. Additional heat requirements, if any, are supplied by natural gas. Additional heat was required for both test runs.

The flue gas from the combustion chamber passes through a single-stage hot cyclone to remove entrained dust. Diluting air and/or water quenching is used to cool the flue gas stream prior to the baghouse which removes the very fine dust not removed by the hot cyclone. During Test 2, the flue gas stream passed through a wet scrubber prior to venting to the atmosphere. The wet scrubber was not utilized during Test 1.

3.3 Test Procedure

Each test was preceded by a "warm-up" period during which the kiln and vapor recovery system were brought up to operating temperature by processing oil sand only. During each test, PCB oil was pumped directly into the pre-heat section of the processor where it mixed with the incoming oil sand.

A summary of the general feed assays and retort and combustion zone operating temperatures are found in Table 1.

Immediately after the PCB addition period, sufficient oil sands were fed to purge out the remaining PCB feed soils. At the end of each test run, the liquid product inventories were sampled. Some PCB feed soil material was held up in the pre-heat section of the reactor as "wall cake". This material was sampled at the end of Test 1 and contained 17,700 ppm PCB at the cool end and 27 ppm PCB at the hot end of the pre-heat zone. The wall cake was not included in the overall material balance for PCBs for Test 1 due to the unknown quantity of wall cake.

The PCB holdup in the oil recovery system was accounted for, to the degree measurable, at the start of Test 2. The PCB holdup in the system at the start of Test 2 is listed in Table 3 and consists of overhead oil, sour water, sidedraw oil, bottoms oil, and wall cake. The PCBs in the wall cake were not quanitifiable, however, PCBs from the wall cake may have been transfered to the liquid holdup during the Test 2 warm up period.

The effect of PCB holdup in the process equipment is less significant with longer operating periods. The duration of the full-scale test runs were limited by PCB material availability and Canadian government regulations. Test 1 consisted of a 2-hour PCB feed period and a 2.5-hour product collection period. Test 2 consisted of a 4-hour PCB feed period and a 4.5-hour product collection period.

During Test 2, the time between the baghouse cleaning cycles was increased to improve the efficiency of the baghouse.

3.4 Test Results

The measurements made during the test runs are presented in raw data form in Appendix A.

3.4.1 PCB Material Balance

A material balance indicating the partition of PCBs among the process products is presented in Tables 2 and 3. In the 2-hour run (Test 1), the PCB feed soil concentration averaged 0.7 percent PCB by weight. In the 4-hour run (Test 2), the PCB feed soil concentration averaged 1.5 percent PCB by weight. In both test runs, the PCB in the treated soil was reduced to less than 0.1 ppm PCB.

During Test 1, 94.5 percent by weight of the feed PCBs were accounted for in the products. During Test 2, 93.2 percent by weight of the PCBs were accounted for in the products. These balances are reasonable considering

the size of the processing equipment relative to the duration of each test.

In both tests, more than 99.5 percent of the recovered PCBs were in the recondensed hydrocarbon liquids from the fractionating tower (bottoms oil, sidedraw oil, and overhead oil). The PCBs were more highly concentrated in the heavier hydrocarbon fractions.

3.4.2 PCB in the Flue Gas

Some PCBs were detected in the flue gas during both test runs, see Table 4. During Test 1, the flue gas was sent through a cyclone and baghouse only. During Test 2, the flue gas was sent through a cyclone, bag house, and a wet scrubber. The flue gas was sampled during both tests using the EPA Modified Method 5 (MM5) sampling train. Because of the modification in flue gas processing equipment, the flue gas sampling location was not identical for both test runs.

The flue gas cleaning system removed 17 and 63 percent by weight of the PCBs in the flue gas stream for Tests 1 and 2, respectively, see Tables 2 and 3. The quantity of PCBs released with the cleaned flue gas stream was 0.31 and 0.02 percent by weight of the PCB feed for Tests 1 and 2, respectively.

During commercial operation, the fines recovered by the flue gas cleaning system will be reprocessed as required to reduce the PCBs in an acceptable level.

The source of the PCBs in the flue gas results from internal leaks in the processor between the pre-heat zone and the downstream portion of the combustion zone. The PDU is heavily instrumented with thermocouples which provide conduits between the zones. Between Test 1 and Test 2 an attempt was made to seal leaks through loose or empty thermocouple holes in the shell separating the pre-heat zone and the combustion zone. During Test 2, the total quantity of PCBs entering the flue gas processing train was

reduced by a factor of two despite a four-fold increase in the total PCB quantity fed to the processor:

	Total PCBs in Feed Soils Pounds	Total PCBs Entering Flue Gas Processing Train Pounds	Total PCBs in Processed Flue Gas Stream Pounds
Test 1	117.5	0.42	0.36
Test 2	440.6	0.24	0.09

In Test 2, the combination of the leak repairs and the addition of the wet scrubber to the gas cleaning train significantly reduced the PCBs released in the processed flue gas:

	Grams of PCBs in Untreated Flue Gas Per Kilogram of PCB in Feed	Grams of PCBs in Processed Flue gas Per Kilogram of PCB in Feed	Flue Gas Cleaning Efficiency
Test 1 (no wet scrubber)	3.6	3.1	14 Percent
Test 2 (wet scrubber used)	0.5	0.2	60 Percent

The leakage between the pre-heat and combustion zone will be eliminated in the new processor constructed for field remediation work. As a safeguard measure, the new processor will employ a flue gas cleaning train consisting of a cyclone, baghouse, wet scrubber, and gas phase activated carbon designed to effectively clean the flue gas to levels less than 0.001 gram PCB in exiting flue gas per kilogram of PCB in the feed. The new processor will include additional improvements, such as larger reaction and combustion zones, approximately 50 and 30 percent larger in relative terms, to increase time and reduce particulate entrainment.

3.4.3 PCB Contamination in Flare Gas

An XAD gas trap was installed by Chemex Labs Alberta, Inc. (Chemex) on the flare gas line. The analytical results of the gas sample are presented in Appendix B.

Chemex was not able to detect PCBs in the flare gas.

3.4.4 Furans and Dioxins

During Test 1, furans were detected in the exiting flue gas stream, see Table 5. No dioxins were detected in the flue gas stream. No other streams were analyzed for furans or dioxins.

Based on the furans detected during Test 1, the Test 2 PCB oil feed was evaluated as a potential source for furans. During Test 2, furans were detected in the flue gas and PCB oil feed. The presence of furans has been documented as an impurity in commercial mixtures of PCBs (Erickson, Mithcell D., Analytical Chemistry of PCBs, Butterworth Publishers, Stoneham, MA, 1986). The flue gas contained 14 percent by weight of the tetrachlorodibenzofurans detected in the PCB feed oil. Dioxins were not detected in any of the samples analyzed.

Based on the absence of dioxins in the flue gas, the furans in the flue gas are from the furans in the PCB feed oil only. As mentioned earlier, a gas phase activated carbon absorption system will be used in the flue gas processing train during commercial operations.

3.4.5 Flue Gas and Flare Gas Composition

The compositions of the flue gas and the flare gas were measured continuously during the pilot operation. The results of these measurements are presented in Appendix C.

In commercial units, the flare gas will be injected into a small pre-combustion chamber where the gases will be burned. The gases exiting the pre-combustion chamber will then flow into the processor combustion zone.

4.0 HEALTH AND SAFETY MONITORING

Prior to conducting the test runs, all employees working at the site were provided with Health and Safety training. This training included the health hazards associated with PCBs and its decomposition products, the physical properties of the chemicals, and the proper usage of a variety of personal protective equipment (including respiratory protection and protective clothing). Qualitative "fit" testing of the half-mask respirators was conducted using amyl acetate. The training also included demonstrations of the effective method for donning and doffing a personal protective equipment ensemble comparable to Level C. Personal habits and the effect on chemical absorption were emphasized. These habits included personal hygiene, when and where it would be acceptable to eat, drink, and smoke, and the correct procedure to follow to doff the protective equipment without contaminating other areas.

As part of the evaluation of potential exposure to employees to PCBs, air monitoring was conducted before the Test 1 to establish background levels at various points surrounding the pilot plant. The locations of the monitoring equipment were also used to evaluate concentrations during the test runs. During the test runs, the employees utilized the following personal protective equipment as appropriate for their assigned job duties.

- Scott half-mask respirator with organic vapor cartridges.
- Polyethylene coated Tyveks or polypropylene disposable coveralls with boot coverings.
- Polyvinyl Latex inner gloves.
- Polyvinylchloride outer gloves.
- Safety glasses.

- o Hard hat with face shield.
- o Safety boots.

4.1 Air Monitoring

The background and potential exposure monitoring were conducted as area samples at four locations. The equipment locations were:

1. Outside plant - 50 feet from baghouse;
2. Condenser side of kiln;
3. Conveyor side of kiln;
4. Center of plant floor - five feet high.

The purpose of this monitoring was to determine if PCB vapors and/or particulates were being emitted into the plant during operation and resulting in a significant potential exposure to employees working in the area.

The sampling and analytical method used was National Institute of Occupational Safety and Health Method Number 5503. In this method, the collection media specified is florisil tubes with backup section and a 13mm glass fiber prefilter. The pumps used were Gilian models which calibrated before and after the monitoring period to a flow rate of approximately 0.2 liter/minute. The collection period varied with the test run. The background samples and the Test 1 run samples collected material for a full-shift duration (8-10 hours). The collection period for Test 2 was reduced closer to the actual test time period, which was approximately 5.5 hours.

The analytical method used by an American Industrial Hygiene Association certified laboratory (Clayton) was gas chromatography with an electron capture detector. The analytical results are presented in Appendix D and Summarized in Table 6.

In general, the monitoring results indicated non-detectable levels of PCBs collected during the background sampling. The laboratory detection limit is reported as 0.06 micrograms for the vapor constituent and 0.05 micrograms for the particulate constituent. The monitoring results obtained during Test 1 were reported as non-detectable with the same limits of detection. The monitoring results obtained during Test 2 ranged from non-detectable to 14 micrograms per cubic meter for the 5.5-hour monitoring period with the same detection limits. An allowable exposure level for Aroclor 1242, which was the test material, has been set by the Occupational Safety and Health Administration. This allowable exposure is 1,000 micrograms per cubic meter for an 8-hour exposure period. The Canadian Department of Health has established the same allowable exposure limit.

The highest concentration reported for which there is a potential employee exposure was at least two orders of magnitude below the allowable limit.

5.0 SAMPLING AND ANALYTICAL QUALITY ASSURANCE/QUALITY CONTROL

To verify the accuracy of the test results, samples of the feeds and products for Test 2 were analyzed by two laboratories. The samples were analyzed by Chemex in Calgary, Alberta, Canada, and Clayton Environmental Consultants, Inc. (Clayton) in Novi, Michigan, United States of America. Many of the samples were not true duplicates but composites of samples taken throughout the run.

5.1 Samples Taken

A list of samples taken during Tests 1 and 2 is presented in Appendix B. Chain-of-custody records for these samples are presented in Appendix E. The sample points are identified on Figure 1.

5.2 Comparison of Analytical Results

Analytical results on the samples provided to Chemex and Clayton are presented in Appendix B. In some cases the results reported by the laboratories varied significantly. In the material balances shown in Tables 2 and 3, the Chemex analyses were used to evaluate the partition of the PCBs in both liquid and solid feed and products. The Clayton analyses of the MM5 gas train samples were used to determine air emissions, since this laboratory is EPA certified and is capable of quantifying the furans and dioxins.

5.2.1 Material Balance Check Analyses

At the end of Test 2, composites of the samples taken during the test were assembled to check the PCB values being used in the material balance calculations. These samples were assayed by Clayton and are summarized in Table 7.

Clayton confirmed that the PCB levels in the tailings were below detection limits. A major discrepancy affecting the material balance is the low PCB concentration measured by Clayton in the PCB feed oil. Clayton has suggested this discrepancy could be caused by the unusually high PCB content of the feed. The Chemex assays for PCB content of the feed were used for the material balance since more PCB was collected in the products than the Clayton assay indicates was in the feed.

5.2.2 Comparison of PCB/Furan/Dioxon Gas Train Results

The results of furan/dioxin analysis of gas train samples analyzed by Chemex and Clayton are presented in Appendix B. The results of the Clayton analyses are summarized in Tables 4 and 5.

Clayton has the capacity to quantify the furans and dioxins in the flue gas. Chemex does not have the capability to quantify furans and dioxins. The Clayton analyses for PCBs, furans, and dioxins were used in the material balances and process analyses.

6.0 CONCLUSIONS

The results from the four-hour test run (Test 2) show that:

1. The processor does not generate dioxins as a result of the anaerobic processing;

2. The treated soils contain no PCBs at a detection limit of 0.1 ppm;

3. The air treatment equipment on the flue gas discharge reduces particulate PCB emissions by 63 percent.

The test results indicate that the Taciuk processor will separate PCBs from soil or sediment. The construction of a transportable Taciuk processor will include additional flue gas treatment with vapor phase carbon to eliminate the flue gas contaminants.

TABLES

TRADE SECRET

TABLE 1

FEED ASSAYS
RETORT AND COMBUSTION ZONE TEMPERATURES

				Temperature Conditions			
Test No.	Component	Assay, %	Feed Rate Tons Per Hour	Retort Zone	Temp. F	Combustion Zone	Temp. F
1	PCB	0.7	4.2	Entrance	1,010	Entrance	1,165
	Oil	2.4		Mid Zone	1,025	Mid Zone	1,185
	Water	2.7		Exit	1,040		
	Solids	94.2		Vapor	1,050		
2	PCB	1.5	3.7	Entrance	1,044	Entrance	1,207
	Oil	2.8		Mid Zone	1,057	Exit	1,269
	Water	1.9		Exit	1,064		
	Solids	93.8		Vapor	1,070		

TABLE 2

PCB MATERIAL BALANCE FOR 2-HOUR TEST[1]
(FULL-SCALE TEST NO. 1)

Description	Weight, LBS.	PCB, PPM	PCB, LBS	Dist., %
Feed:				
PCB Oil	126	935,000	117.53	100.0
Solid Products:				
Product Sand	19,097	<0.1	0.00	0.0
Baghouse Dust	266	195	0.05	0.0
Kiln End Leakage	279	<0.1	0.00	0.0
Flue Gas Cyclone	358	30	0.01	0.0
Hydrocarbon Cyclone	90	<0.1	0.00	0.0
Liquid Products:				
Overhead Oil	1,725	9,830	16.95	14.4
Sour Water	1,551	5	0.01	0.0
Side Draw Oil	48	19,870	0.95	0.8
Bottoms Oil	1,417	65,431	92.73	78.9
Preheat Seal Condensate	2	2	0.00	0.0
Flare Liquids	30		0.00	0.0
Gas Products:		MG/M3		
Flare Gas	143		0.00	0.0
Flue Gas	7,030	69	0.36	0.3
TOTAL PCB IN			117.53	
TOTAL PCB OUT			111.06	
ACCOUNTABILITY, %			94.50%	

[1]PCBs were fed to the processor over a 2-hour period and products were recovered over a 2.5-hour period. Average total feed rate of soil and PCBs was 8,416 lbs/hr.

TRADE SECRET

TABLE 3

PCB MATERIAL BALANCE FOR 4-HOUR TEST[1]
(FULL-SCALE TEST NO. 2)

Description	Weight, LBS	PCB, PPM	PCB, LBS	Dist., %
Feed:				
PCB Oil	469	939,000	440.58	92.4
Starting Inventory:				
Overhead Oil	2,557	8,680	22.19	4.7
Sour Water	294	8	0.00	0.0
Side Draw Oil	117	10,600	1.24	0.3
Bottoms Oil	777	16,200	12.59	2.6
Wall Cake	Unknown	27-17,700		
Solid Products:				
Product Sand	30,195	<0.1	0.00	0.0
Baghouse Dust	238	240	0.06	0.0
Kiln End Leakage	471	<0.1	0.00	0.0
Flue Gas Cyclone	658	12	0.01	0.0
Hydrocarbon Cyclone	210	1	0.00	0.0
Liquid Products:				
Overhead Oil	1,639	24,600	40.31	8.5
Sour Water	2,414	24	0.06	0.0
Side Draw Oil	48	19,870	0.95	0.2
Bottoms Oil	2,552	157,725	402.48	84.4
Preheat Seal Condensate	4	738	0.00	0.0
Scrubber Water	4,880	13	0.08	0.0
Flare Liquids	61		0.00	0.0
Gas Products:		MG/M3		
Flare Gas	263		0.00	0.0
Flue Gas	13,770	9	0.09	0.0
TOTAL PCB IN			476.60	
TOTAL PCB OUT			444.04	
ACCOUNTABILITY, %			93.17%	

[1]PCBs were fed to the processor over a 4-hour period and products were recovered over a 4.5-hour period. Average total feed rate of soil and PCBs was 7,374 lbs/hr.

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TABLE 4

PCBS IN FLUE GAS AND OIL FEED

Test No.	PCB Concentration in Flue Gas $\mu g/m^3$	Total Mass PCB in Flue Gas, gm	Total Mass PCB in Oil Feed, Kg
1	68,600	195	53.6
2	8,630	48	200.0

Notes:

[1]Flue gas stream sampled using EPA Modified Method 5 sampling train.

[2]Values based on analysis by Clayton Environmental Consultants, Inc., see Appendix C for raw analytical data.

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TABLE 5

FURANS AND DIOXINS IN FLUE GAS AND OIL FEED

Test No.	Compound	Concentration In Flue Gas, ng/m^3	Total Mass In Flue Gas, mg	Total Mass in Feed, mg
1	2,3,7,8 Tetra-chlorodibenzofuran	13	0.037	NA
	Total Tetra-chlorodibenzofurans	126	0.36	NA
	2,3,7,8 Tetra-chlorodibenzo-p-dioxin	<11	-	NA
2	2,3,7,8 Tetra-chlorodibenzofuran	75	0.42	20.2
	Total Tetra-chlorodibenzofurans	1,934	10.8	78.8
	2,3,7,8 Tetra-chlorodibenzo-p-dioxin	<29	-	-

Notes:

[1]NA - Not Analyzed

[2]Values based on analysis by Clayton Environmental Consultants, Inc., see Appendix C for raw analytical data.

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TABLE 6

SUMMARY OF PCB MONITORING RESULTS
FOR AROCLOR 1242

BACKGROUND MONITORING

Date	Sample Location	Volume (L)	Florisil ng	Filter ng	Total ng/m3
4/18/88	Center of Plant Floor Five Feet High	152	ND	ND	ND
4/18/88	Conveyor Side of Kiln	172	ND	ND	ND
4/18/88	Condenser Side of Kiln	170	ND	ND	ND
4/18/88	Outside Plant	148	ND	ND	ND

FIRST PILOT RUN

Date	Sample Location	Volume (L)	Florisil ng	Filter ng	Total ng/m3
4/19/88	Center of Plant Floor Five Feet High	93	ND	ND	ND
4/19/88	Conveyor Side of Kiln	93	ND	ND	ND
4/19/88	Condenser Side of Kiln	102	ND	ND	ND
4/19/88	Outside Plant	93	ND	ND	ND

SECOND PILOT RUN

Date	Sample Location	Volume (L)	Florisil ng	Filter ng	Total ng/m3
5/12/88	Center of Plant Floor Five Feet High	52	0.21	0.09	5.8
5/12/88	Condenser Side of Kiln	50	0.26	0.14	8.0
5/12/88	Conveyor Side of Kiln	56	0.68	0.09	14.0
5/12/88	Outside Plant	56	<0.07	<0.07	ND

ND - Not Detected

TABLE 7

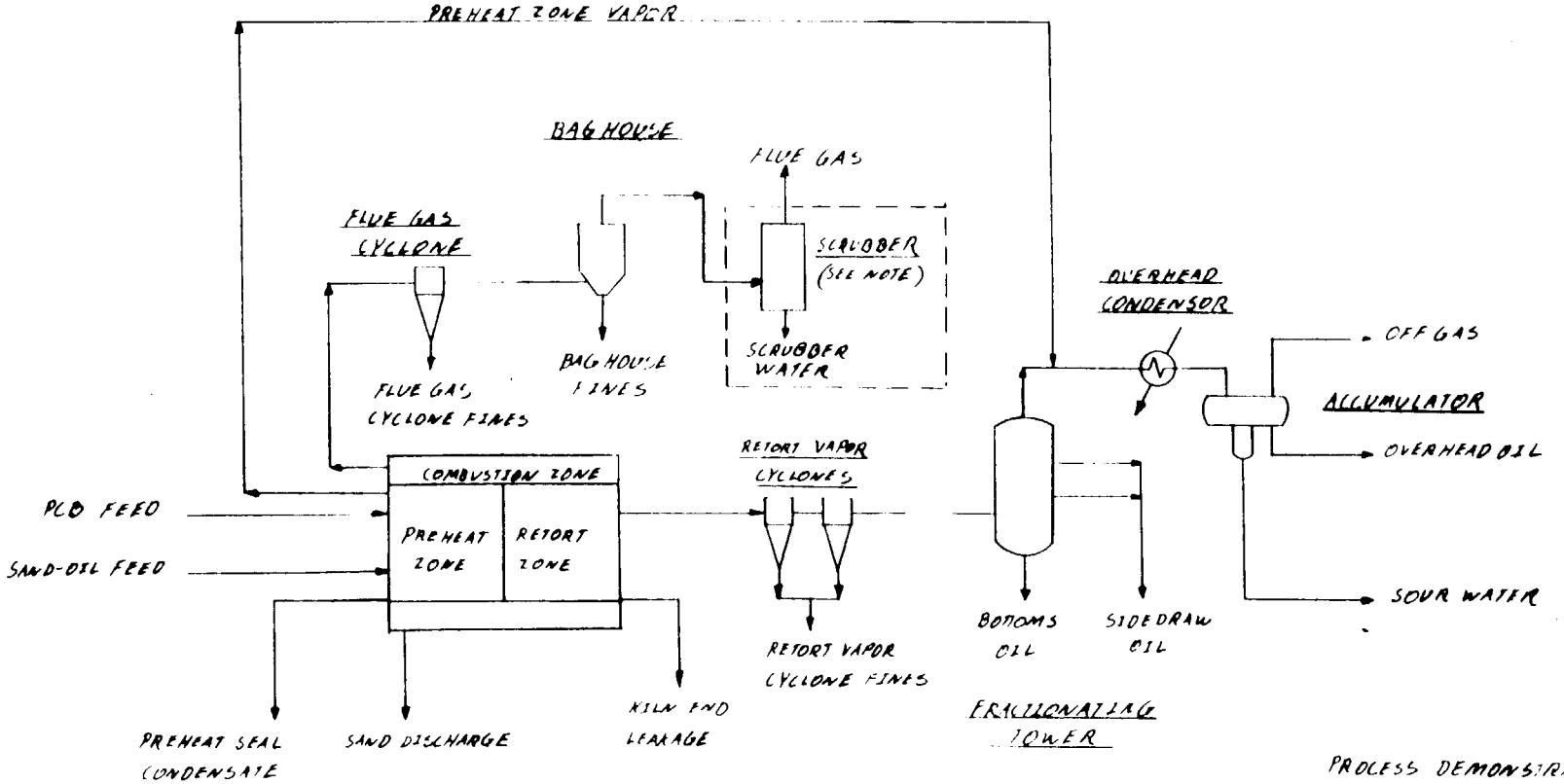
SUMMARY OF CHEMEX AND CLAYTON PCB ASSAYS, TEST 2

Sample Location	Chemex Assay[1] ppm	Clayton Assay, ppm
Feed:		
PCB Oil Feed Composite	939,000	520,000
Solid Products:		
Kiln End Leakage Composite	<.1	0.3
HC Cyclone Fines Composite	1	<0.3
Flue Gas Cyclone Composite	12	11
Baghouse Fines Composite	240	170
Tailings Discharge Composite	<.1	<0.3
Liquid Products:		
Overhead Oil Composite	24,600	21,000
Bottoms/Sidedraw Oil Composite	155,180	91,000
Sour Water Composite	24	0.033
Scrubber Liquid Composite	13	0.15

[1]Chemex Assay values of solids and liquids were used in the material balance calculations for Test 2.

TRADE SECRET

FIGURES



ANAEROBIC THERMAL PROCESSOR

NOTE: THE SCRUBBER WAS USED DURING TEST 2 ONLY

PROCESS DEMONSTRATION UNIT
PROCESS FLOW DIAGRAM.

FIGURE 1

SOILTECH, INC. ©
'77

TRADE SECRET

APPENDIX
A

APPENDIX A

RAW DATA

PCB FEED

worksheet PCBWT.WK1 yields 125.7 lbs (PCB + solvent)

	PCB feed	% PCB's		
CHEMEX data	15:00	95 %	:	AVG.
	17:00	92 %	:	93.5 %

PCB feed (lbs) = 125.7 x 0.935 = 117.53

END INVENTORY

		lbs	CHEMEX PCB conc ppm	CHEMEX PCB conc mf.		lbs
OVERHEAD OILS	ovhd drum	1724.7	9830	0.009830	=	16.95
SOLID WASTE	ovhd drum	293.7	13.4	0.000013	=	0.00
	drums	1257.0	3	0.000003	=	0.00
SIDE DRAW	piping	48.0	19870	0.019870	=	0.95
BOTTOMS OIL	bbl#1	442.0	69050	0.069050	=	30.52
	bbl#2	410.0	69200	0.069200	=	28.37
	bbl#3	473.0	65350	0.065350	=	30.91
	filters & piping	92.2	65350	0.065350	=	6.03
TAILINGS SAND	7638.9 lbs/hr					
	2.5 hours					
		19097.3	0.1	0.000000	=	0.00
BAGHOUSE	106.4 lbs/hr					
	2.5 hours					
		266.0	195	0.000195	=	0.05
KILN END LEAKAGE	111.4 lbs/hr					
	2.5 hours					
		278.5	0.1	0.000000	=	0.00
FLY ASH CYCLONE	143.1 lbs/hr					
	2.5 hours					
		357.8	30	0.000030	=	0.01
PREHEAT SEAL CONDENSATE		2.2	1.9	0.000002	=	0.00
HC CYCLONE	36 lbs/hr					
	2.5 hours					
		90.0	0.1	0.000000	=	0.00

MINERAL BALANCE

RUN DATE April 19, 1988
WINDOW 20 VERSION 1
REV 1 PAGE 2

STREAM NUMBER	STREAM DESCRIPTION	SOLIDS (lb/hr)	LOI (wt%)	MINERAL (lb/hr)	
111	CONV TAILINGS	7609.2	0.2	7593.4	by difference
130	FLUE CYCL DUST	143.1	1.2	141.4	
136	BAGHOUSE DUST	266.0	4.3	181.8	
109	KILN END LEAK	111.4	0.3	111.1	
150	HC CYCL DUST	90.0	4.2	34.5	
157	BOTTOM OIL	16.6	7.6	15.3	
154	DAYTANK OIL	0.0	0.0	0.0	

WATER BALANCE

STREAM NUMBER	STREAM DESCRIPTION	RATE (lb/hr)	(wt % of feed)
103	PREHEAT VENT	0.0	0.0
104	RETORT VAPOUR	305.8	133.4
	TOTAL	308.8	133.4

propane (fuel not measured, use previous run ratios)

	diesel	propane	
871112w20	43.8	8.6	lbs/hr of C as
871112w30	66.4	8.6	CO and CO2
	55.1	8.6	

so use propane C as CO,CO2 as 8.3 lbs/hr
so overall propane rate = 18.2 lbs/hr
and H2 = 1.9 lbs/hr

LOI weight % on oil mix feed solids extracted by Dean&Stark

feed	(a)	(b)	
	1.341	1.278	
	1.223	1.276	AVG= 1.28833 wt %
	1.239	1.373	

C as CO,CO2 or COKE on feed 182.8 lbs/hr

OILS overall inventory change yields 100.4 lbs/hr
bottoms oil solids = 16.6 lbs/hr
clean oil product = 91.8 lbs/hr

STREAM NUMBER	STREAM DESCRIPTION	SOLIDS (lb/hr)	LOI (wt%)	MINERAL (lb/hr)	
111	CONV TAILINGS	7609.2	0.2	7593.4	by difference
130	FLUE CYCL DUST	143.1	1.2	141.4	
138	BAGHOUSE DUST	266.0	4.3	101.8	
109	KILN END LEAK	111.4	0.3	111.1	
150	HC CYCL DUST	90.0	4.2	34.5	
157	BOTTOM OIL	43.5	7.6	40.2	
154	DAYTANK OIL	0.0	0.0	0.0	

WATER BALANCE

STREAM NUMBER	STREAM DESCRIPTION	RATE (lb/hr)	(wt % of feed)
103	PREHEAT VENT	0.0	0.0
104	RETORT VAPOUR	506.2	220.4
	TOTAL	506.2	220.4

propane (fuel not measured, use previous run ratios)

	diesel	propane	
871112w28	43.8	8.5	lbs/hr of C as
871112w38	66.4	8.6	CO and CO2
	55.1	8.6	

so use propane C as CO,CO2 as 7.7 lbs/hr
so overall propane rate = 9.5 lbs/hr
and H2 = 1.7 lbs/hr

LOI weight % on oil mix feed solids extracted by Dean&Stark

feed	(a)	(b)	
	1.341	1.278	
	1.223	1.276	AVG= 1.28833 wt %
	1.239	1.373	

C as CO,CO2 or COKE on feed 182.8 lbs/hr

OILS overall inventory change yields 213.1 lbs/hr
bottoms oil solids = 43.5 lbs/hr
clean oil product = 169.6 lbs/hr

	4.5 hours				
	471.2	0.1	0.000000	=	0.00
FLUE GAS CYCLONE	146.2 lbs/hr				
	4.5 hours				
	657.9	11.7	0.000012	=	0.01
PREHEAT SEAL CONDENSATE	4.0	730	0.000730	=	0.00
HC CYCLONE	46.6 lbs/hr				
	4.5 hours				
	209.7	1	0.000001	=	0.00
SCRUBBER WATER	5880 lbs	13.2	0.000013	=	0.08

OFF GASES flare liquid lbs/hr; flare gas lbs/hr; total in lbs; 4.5 hrs

C4&+	13.5	25.7	176.2	1	0.000001	=	0.00
C3&-	0.1	32.8	148.2	0.001	0.000000	=	0.00

C3&- estim by equilibrium at 1/1000 of the liquid conc

FLUE GAS FROM BAGHOUSE
3060.239 lbs/hr @ 29.884 MW
@ 60 F = 0.069614 lbs/ft^3
volumetric rate = 1244.807 m^3/hr
CHEMEX @ 430.4465 ug/m^3= 535822.9 ug/hr
= 0.001181 lbs/hr
over 4.5 hours 0.01

END INVENTORY - lbs ----> 443.96
FEED PCB'S ---- lbs ----> 476.82

CLOSURE -------- % -----> 93.11

Total emissions from the:

FLARE STACK:	C4&+ 176.2 lbs * <1ppm	0.00017620	lbs
	C3&- 148.2 lbs * <1 ppb	0.00000015	lbs
		0.00017635	lbs
		0.00008001	kgs
TAILINGS:	30,195 lbs tot @ .1ppm =	0.0030195	lbs
		0.00137001	kgs
FLUE CYCLONE DUST:	658 lbs* 11.7 ppm=	0.0076986	lbs
		0.00349301	kgs

UMATAC atmospheric distillation results gave slightly lower PCB values in the PCB feed mixture as follows:

Solvents (below 300 deg C B.P.) 2.5ml @ 0.9 S.G. = 2.25 g

PCB ERROR ANALYSIS (mass measurement and laboratory analysis errors)

	mass rate err +-lbs	mass rate err %	PCB's mass rate err +-lbs	MAX PCB's lbs	MIN PCB's lbs	lab anal err % std dev	MAX PCB's lbs	MIN PCB's lbs	Comments
PCB FEED	2.18	0.45	1.97	442.77	438.82	1.38	448.87	432.78	
OVHD OIL	62.50	2.44	0.54	22.73	21.65	0.93	24.76	19.72	+/- .5 inches manometer read
SOUR H20	7.65	2.68	0.00	0.00	0.00	0.93	0.00	0.00	+/- .5 inches manometer read
SIDE DRAW	7.66	7.67	0.00	1.14	0.98	0.93	1.24	0.89	+/- .5 inches manometer read
	0.45	50.00	0.09	0.27	0.09	0.93	0.29	0.08	50 % estimate on pipe inventor
BOTTOMS	7.66	1.00	0.10	9.77	9.57	0.93	10.64	8.72	+/- .5 inches manometer read
	45.95	25.00	0.73	3.65	2.19	0.93	3.97	1.99	25 % estimate on pipe inventor
OVHD OIL	62.50	3.81	1.54	41.85	38.77	0.93	45.58	35.31	+/- .5 inches manometer read
SOUR H20	7.65	2.68	0.00	0.00	0.00	0.93	0.00	0.00	+/- .5 inches manometer read
		1.00	0.00	0.06	0.06	0.93	0.06	0.05	1 % on weigh scale
SIDE DRAW	24.00	50.00	0.48	1.43	0.48	0.93	1.56	0.43	50 % estimate on pipe inventor
BOTTOMS		1.00	0.69	70.19	68.00	0.93	76.45	62.65	1 % on weigh scale
		1.00	0.44	44.69	43.00	0.93	48.68	39.09	1 % on weigh scale
		1.00	0.72	72.97	71.52	0.93	79.48	65.14	1 % on weigh scale
		1.00	0.69	69.43	68.06	0.93	75.63	61.98	1 % on weigh scale
		1.00	0.53	53.21	52.16	0.93	57.96	47.50	1 % on weigh scale
		1.00	0.57	58.02	56.87	0.93	63.21	51.80	1 % on weigh scale
		1.00	0.07	7.06	6.92	0.93	7.69	6.30	1 % on weigh scale
	37.95	25.00	7.66	38.29	22.97	0.93	41.71	20.92	25 % estimate on pipe inventor
TAILINGS		0.45	0.00	0.00	0.00	0.93	0.00	0.00	varies with feed error by diff
BAGHOUSE		1.00	0.00	0.06	0.06	0.93	0.06	0.05	1 % on weigh scale

TACIUK PROCESSOR MASS BALANCE REPORT

RUN DATE May 12, 1988
WINDOW 28 VERSION 1
REV 99 PAGE 1

WINDOW 13:24 to 17:26

RUN CONDITIONS

FEED TYPE	OIL MIXED WITH SAND + PCB's	
FEED RATE	3.69	tons/hour
WINDOW LENGTH	4.03	
FEED COMPOSITION	(wt%)	(lbs/hr)
PCB	1.6	115.5
OIL	2.8	206.9
WATER	1.9	137.9
MINERAL	93.8	6913.8
	100.0	7374.0
OIL RECYCLE	NO	
RPM	@ 4.5	

RETORT TEMPS (F)

ENTRANCE	1044
MID-ZONE	1057
EXIT	1064
VAPOUR	1078

COMBUSTION TEMPERATURES (F)

ENTRANCE	1207
MID-ZONE	N/A
EXIT	1269

HYDROCARBON BALANCE

STREAM #	STREAM DESCRIPTION	C4&+	C3&-	COKE	C as CO&CO2		
101	FEED			-0.2	-73.6		
107	DIESEL FUEL				-33.5		
119	PROPANE FUEL				-5.2		
152	FLARE GAS	25.7	32.8		36.0		
152	FLARE LIQUID	13.4	0.1				
154	DAYTANK OIL	0.0		0.0			
131	FLUE GAS				122.9		
111	CONV TAILINGS			9.3			
130	FLUE CYCL DUST			0.7			
138	BAGHOUSE DUST			1.6			
199	KILN END LEAK			0.2			
150	HC CYCL DUST			0.7			
157	BOTTOM OIL	131.5		3.6			
126	PREHEAT VENT	0.0					
	TOTALS (lb/hr)	170.7	32.9	7.9	46.6	=	258.1
	(% OF PRODUCTS)	66.1	12.8	3.1	18.1	=	100.0
	(% OF FEED)	52.9	10.2	2.4	14.5	=	80.1

MASS BALANCE CALCULATIONS RUN DATE May 12, 1988
WINDOW 20 VERSION 1
WINDOW 13:24 17:26 4.83333 hours REV 99 PAGE 3

FEED RATE

14.8788 tons in 4.83333 hours
3.68788 tons/hour
7374.88 lbs/hr

FEED QUALITY

	(a)	(b)	AVG. mass%	lbs/hr
oil	2.9	2.8	2.85	218.2
water	2.8	1.8	1.9	148.1
solids	95.1	95.4	95.25	7823.7

PCB's 469.2 lbs in 4 hours = 117.3

PCB	117.3	1.57	7491.38
oil	218.2	2.81	
water	148.1	1.87	
solids	7823.7	93.76	

Bottoms OIL 995.2 lbs in 4.83333 hours= 246.7 lbs/hr
TIF 19.87 % solids= 47.1 lbs/hr
clean= 199.7 lbs/hr

SOLIDS	COLLECT lbs	TIME hours	RATE lbs/hr	LOI %	COKE lbs/hr	SOLIDS lbs/hr
kiln end leak	184.7	1	184.7	0.236	0.2	184.5
HC cyclone	198.2	4.25	46.6	1.44	0.7	46.0
flue gas cyclone	146.2	1	146.2	0.448	0.7	145.5
baghouse	216.03	4.09	52.8	3.894	1.6	51.2
bottoms oil	47.8548	1	47.1	7.6	3.6	43.5
						347.1

clean tailing sand= 7823.7 - 347.1 = 6676.6
LOI on tailings (mass%) 0.139
coke on tails = 9.3

C asCO,CO2

	time	Igal	Igal	temp	API	SG
diesel	13:30	14827.9		60	41	0.82020
	17:30	14846.8	18.9	60	41	0.82020

time= 4 hours
rate= 38.8 lbs/hr

C as CO,CO2 = 33.5
H2 = 5.3

CHEMEX
Labs Alberta (1984) Ltd.

CALGARY
2021 - 41 AVENUE N.E.
CALGARY, ALBERTA, CANADA T2E 6P8
TELEPHONE (403) 291-0077
TELEX 03-821561

GRANDE PRAIRIE
7128 - 116 STREET
GRANDE PRAIRIE, ALBERTA, CANADA T8V 5R4
TELEPHONE (403) 539-5541

EDMONTON
9331 - 48 STREET
EDMONTON, ALBERTA, CANADA T6B 2R4
TELEPHONE (403) 466-2577

HIGH LEVEL
10006 - 98 STREET
HIGH LEVEL, ALBERTA, CANADA T0H 1Z0
TELEPHONE (403) 926-3600

CERTIFICATE OF ANALYSIS

• GAS • WATER • OIL • SOILS • VEGETATION • ENVIRONMENTAL ANALYSIS

UMATAC INDUSTRIAL PROCESSES

DATE JULY 5, 1988 KB

PROJECT NO. UMAT010 1001 88-4563

LONG RUN PCB BURN MAY 12/88

SAMPLE DESCRIPTION	TOC%
M. CYCLONE 1530-1730	2.22
OILY SAND 1030-1800 A	3.00
OILY SAND 1030-1800 B	2.98
BAG HOUSE FINES 1530-1730	0.67
KILN END COMP. 1400-1730	0.13
TAILINGS COMP. 1400-1730	0.06
FLUE CYCLONE COMP. 1400-1730	0.15

SAMPLE DESCRIPTION		TOLUENE INSOLUBLES %
BOTTOM OIL 1540 & 1647		20.7
BOTTOM OIL	1200	18.3
BOTTOM OIL	1725	0.10
BOTTOM OIL	1730	0.07
BOTTOM OIL	1810	0.35
BOTTOM OIL	1830	0.07
BOTTOM OIL STARTING INVENTORY 1340		18.2

SAMPLE DESCRIPTION	% OIL	% WATER	% SOLIDS
FEED OILY SAND (A)	2.8	1.5	95.7
FEED OILY SAND (B)	2.7	1.7	95.6

Certified by

TRADE SECRET

APPENDIX
B

APPENDIX B

ANALYTICAL RESULTS

TEST 1

ANALYTICAL RESULTS
CHEMEX LABS ALBERTA, INC.

CHEMEX

Labs Alberta Inc.

April 19, 1988

UMATAC Industrial Processes

Attention: W. Taciuk

PCB run

Sample	Date	Time	PCB Analysis
Off gas sampler liquid	880419	1930	- 1 ppm
Baghouse fines, top 1/3 of barrel	880419	mid-end of PCB spike	195 ppm
PCB feed (oil)	880419	1800	95%
Preheat seal condensate	880419	16:16-20:00	1.9 ppm
Side draw final end inventory	880419	20:00 final inventory	19,870 ppm
Overhead oil final inventory	880419	20:00 final inventory	9830 ppm
Bottoms oil SBL #3	880419	19:20	65,350 ppm
Bottom Oil	880419	18:50	69,050 ppm
Tailings sand	880419	18:30	- 0.1 ppm
PCB feed (oil)	880419	17:00	92%
Sour H^{2}O water portion (36.4 mls)	880419	17:08-18:37	13.4 ppm
oil portion 2.9 mls			1850 ppm
Bottoms oil SBL #1	880419	18:40	62,040 ppm

...continued

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GRANDE PRAIRIE #106, 8502 - 112th Street, Grande Prairie, Canada T8V 6X4 Tel.: (403) 539-0227
RAINBOW LAKE c/o General Delivery, Rainbow Lake, Canada T0H 2Y0 Tel.: (403) 956-3551
Banff Avenue & Highway 56 Aurora 1-(403)-561-4228
ESTEVAN, SASK. Assay Analytical Laboratories Ltd. [illegible]

Flue gas cyclone	880419	18:00	30 ppm
Flare gas XAD² Resin 240 litres of gas	880419	16:53-18:13	- 0.12 ug/cu^{1}
Stack gas XAD² Resin 233 litres of gas	880419	16:20-18.20	- 0.12 ug/cu^{1}
Preheat Zone build-up (hot end)	880419		27 ppm
Preheat zone build-up	880419		17,700 ppm
Hydrocarbon cyclone	880419		- 0.1 ppm
Flare line condensate end of inventory	880419		- 1.0 ppm
Bottoms oil BBL #2	880419	19:00 hrs.	69,200 ppm
Sour water final inventory	880419	20:00 hrs. (92mls)	3.0 ppm

* All PCB was identified as 1242, there was no indication of any other arochlors present.

** The detection limit on this sample can be improved and is currently being reprocessed.

TRADE SECRET

TEST 2

ANALYTICAL RESULTS
CHEMEX LAB ALBERTA, INC.

CHEMEX

Labs Alberta Inc.

UMATAC INDUSTRIAL PROCESSES

UMAT010 1001 88-7214

ATTENTION: B. TACIUK

	TIME	SAMPLE TYPE	PCB's ppm (wt/wt)	AROCLOR
FEED OIL	----	OIL	948,400	1242
BOTTOMS OIL	1340	OIL	16,200	1242
SIDE DRAW OIL	1340	OIL	10,600	1242
OVERHEAD OIL	1340	OIL	8,580	1242
SOUR H_2O (NO OIL)	1600-1725	WATER	26.5 (wt/vol)	1242
SOUR H_2O (NO OIL) END INV.	1820	WATER	7.64 (wt/vol)	1242
BOTTOM OIL	1540 & 1647	OIL	142,400	1242
BOTTOM OIL	1700	OIL	156,900	1242
BOTTOM OIL	1725	OIL	201,800	1242
BOTTOM OIL	1730	OIL	184,300	1242
BOTTOM OIL	1810	OIL	134,400	1242
BOTTOM OIL	1830	OIL	127,100	1242
BOTTOM OIL COMPOSITE	----	OIL	179,794	1242
SAMPLER LIQUID BOMB	----	OIL	-1	1242
OVERHEAD - END INV.	1820	OIL	24,600	1242

FOU PON

NOTE; MINUS SIGN (-) DENOTES "LESS THAN".

FP/KB

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GRANDE PRAIRIE #105, 9502 - 112th Street, Grande Prairie, Canada T8V 5X4 Tel.: (403) 532-0227
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STETTLER Bay 6, #707 - 42 Street Stettler, Canada T0C 2L0 Tel: (403) 742-1107
ESTEVAN, SASK. Apex Analytical Laboratories Ltd., 483 Devonshire St., Estevan, Canada Tel.: (306) 634-9112

CHEMEX

Labs Alberta (1984) Ltd.

UMATAC INDUSTRIAL PROCESSES UMAT010 1001 88-7214

ATTENTION: B. TACIUK

	SAMPLE TYPE	PCBs ppm (wt/wt)	AROCLOR
SCRUBBER H_2O - COMP.	WATER	0.044 (wt/vol)	1242
PREHEAT SEAL CONDENSATE	WATER	738 (wt/vol)	1242
TAILINGS SAND	SOLIDS	0.2	1242
FLUE CYCLONE	SOLIDS	11.7	1242
KILN END LEAK	SOLIDS	0.1	1242
BAGHOUSE	SOLIDS	249	1242
HC - CYCLONE	SOLIDS	1.	1242
XAD ON SCRUBBER 90 ft^3	XAD RESIN	6.0 micrograms	1242
MOD MM5 BAGHOUSE 90 FT^3	XAD RESIN	1980 micrograms	1242
FLARE STACK 7201	XAD RESIN	NO PCB'S	---

FOU PON

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EDMONTON 9331 - 48 Street, Edmonton, Canada T6B 2R4 Tel. (403) 465-9877
GRANDE PRAIRIE #106, 8502 - 112th Street, Grande Prairie, Canada T8V 5X4 Tel. (403) 532-0227
HIGH LEVEL 10509 - 95 Street, High Level, Canada T0H 1Z0 Tel. (403) 926-2448
ESTEVAN, SASK Apex Analytical Laboratories Ltd., 483 Devonian St., Estevan, Canada Tel. (306) 634-6112

TEST 2

PRELIMINARY ANALYTICAL RESULTS
POLYCHLORINATED BIPHENYLS
CLAYTON ENVIRONMENTAL CONSULTANTS, INC.

VERBAL ANALYTICAL RESULTS
CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
TEST 2

Sample Description	PCB Conc.	Aroclor
PCB Oil Feed Composite	520 mg/g	1242
Kiln End Leakage Composite	0.3 ug/g	1242
Scrubber Liquid Composite	0.15 mg/l	1242
Baghouse Fines Composite	170 ug/g	1248
Flue Gas Cyclone Fines Composite	11 ug/g	1248
Overhead Oil Composite	21 mg/g	1242
Tailings Discharge Composite	<0.3 ug/g	1242
Sour Water Composite	0.033 mg/l	1232
Bottoms Oil Sidedraw Oil Composite	91 mg/l	1242
H.C. Cyclone Fines Composite	<0.3 ug/g	1242
Unspiked Sand Feed Composite	<0.3 ug/g	1242

TEST 2

PRELIMINARY ANALYTICAL RESULTS
DIOXINS AND FURANS
CLAYTON ENVIRONMENTAL CONSULTING, INC.

VERBAL ANALYTICAL RESULTS
CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
TEST 2

	PCB Oil Feed Composite ng/gm	Tailings Discharge Composite ng/gm	Unspiked Sand Feed Composite ng/gm
2,3,7,8-Tetrachlorodibenzo-p-dioxin	-	-	-
Total Tetrachlorodioxins	-	-	-
2,3,7,8-Tetrachlorodibenzo-p-furan	95	0.43	-
Total Tetrachlorofurans	370	2.5	-
Total Pentachlorodioxins	-	-	-
Total Pentachlorofurans	250	-	-
Total Hexachlorodioxins	-	-	-
Total Hexachlorofurans	56	-	-
Total Heptachlorodioxins	-	-	-
Total Heptachlorofurans	37	-	-
Total Octachlorodioxins	-	-	-
Total Octachlorofurans	-	-	-

Dash (-) denotes below detectable limits. Detection limits not available with the preliminary results.

APPENDIX C

APPENDIX C

FLUE GAS AND FLARE GAS ANALYSIS

TEST 1

PRELIMINARY FLUE GAS RESULTS
FURANS AND DIOXINS
CLAYTON ENVIRONMENTAL CONSULTANTS, INC.

Ms. Irene Fanelli
CANONIE ENVIRONMENTAL
1825 South Grant St., Ste. 260
San Mateo, CA 94402

Dear Ms. Fanelli:

Heare are the preliminary results on the MM5 stack train. The samples were combined into two fraction. Fraction one was the XAD-resin and the filter. Fraction two was the liquid samples and washes.

	XAD ng	Washes ng
2,3,7,8-tetrachlorodibenzo-p-dioxin	<11	<9
Total tetrachlorodibenzodioxins	<11	<9
2,3,7,8-tetrachlorodibenzofuran	12	10
Total tetrachlorodibenzofurans	124	105
Total pentachlorodibenzodioxins	<2	<.7
Total pentachlorodibenzofurans	<2	3
Total hexachlorodibenzodioxins	<.5	<.8
Total hexachlorodibenzofurans	<.3	<.3
Total heptachlorodibenzodioxin	<1.3	<1.1
Total heptachlorodibenzofurans	<.8	<.5
Octachlorodibenzodioxin	<20	<30
Octachlorodibenzofuran	<7	<12

Very truly yours,

Paul S. Epstein , Ph.D.
Technical Supervisor
/PSE

TEST 1

FINAL FLUE GAS RESULTS
FURANS AND DIOXINS
CLAYTON ENVIRONMENTAL CONSULTANTS, INC.

Clayton Environmental Consultants, Inc.

22345 Roethel Drive • Novi, Michigan 48050 • (313) 344-1770

June 14, 1988

Ms. Irene Fanelli
CANONIE ENVIRONMENTAL SERVICES
1825 South Grant Street
Suite 260
San Mateo, CA 94402

Clayton Project No. 48641-17
Final Report

Dear Ms. Fanelli:

The following is our final report for the samples submitted on April 28, 1988 for the determination of polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs).

The samples were analyzed following a method based on the U.S. Environmental Protection Agency (EPA) Region VII method "Determination of 2,3,7,8-TCDD in Soil and Sediment (Revised September 1983)" and U.S. EPA Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Method 8280, SW-846, Third Edition. A summary of the methodology and quality assurance is enclosed.

There were detectable amounts of PCDFs found in both composited samples. A summary of the results is provided in the enclosed table.

The dioxin equivalency calculations are based on formulas from "Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins and -Dibenzofurans (CDDs and CDFs), U.S. EPA 625/3-87/012." The calculations are made on a "worst-case basis." The limit of detection for each congener was used if PCDD or PCDF was not detected.

If you have any questions, please call Paul Epstein at (313) 344-1770.

Sincerely,

Robert Lieckfield Jr., C.I.H.
Manager, Laboratory Services

RL:kf
Enclosure

Analytical Results
for
CANONIE ENVIRONMENTAL SERVICES
Clayton Project No. 48641-17

Lab Number: Sample Description: Compound	631669 Composite 88-0279-40 88-0279-44 (ng)	631670 Composite 88-0279-41 88-0279-42 88-0279-45 (ng)	631672 Composite 88-0279-43 (Blank) 88-0279-46 (ng)
2,3,7,8-tetrachlorodibenzo-p-dioxin	<11	<9	<0.41
Total tetrachlorodibenzodioxins	<11	<9	<0.41
2,3,7,8-tetrachlorodibenzofuran	12	10	<0.23
Total tetrachlorodibenzofurans	120	100	<0.23
Total pentachlorodibenzodioxins	<1.5	<0.7	<3.5
Total pentachlorodibenzofurans	<2.2	3	<0.54
Total hexachlorodibenzodioxins	<0.53	<0.83	<0.99
Total hexachlorodibenzofurans	<0.26	<0.27	<0.5
Total heptachlorodibenzodioxin	<1.3	<1.1	<1.7
Total heptachlorodibenzofurans	<0.81	<0.55	<0.77
Octachlorodibenzodioxin	<20	<30	<11
Octachlorodibenzofuran	<6.9	<12	<4
Dioxin Equivalency Calculation	13	11	2.3

CANONIE ENVIRONMENTAL SERVICES
Clayton Project No. 48641-17

Methodology for Analysis of PCDD/PCDF

Extraction

Sorbent Tubes

The XAD portion of each sorbent tube was spiked with 100 microliters (uL) of the isotopically-labeled internal standards and surrogate solution and extracted for 18 hours with toluene in a Soxhlet extractor. The extracts were reduced to 1 milliliter (mL) on a rotary evaporator at 55 ^{o}C.

Liquid Samples

Each liquid sample was serially extracted three times with methylene chloride. The extracts were then combined and reduced to 1 mL on a rotary evaporator at 55 ^{o}C.

Cleanup

The extracts were washed in a 20% potassium hydroxide/water solution and then in concentrated sulfuric acid. The extract was transferred to a 20-millimeter (mm) outside diameter (OD) x 230-mm glass column packed with a glass wool plug followed successively by 1.0 gram (g) of silica gel, 2.0 g of silica gel containing 33% (w/w) 1 M sodium hydroxide (NaOH), 1.0 g of silica gel, 4.0 g of silica gel containing 44% (w/w) concentrated sulfuric acid (H_2SO_4), and 2.0 g of silica gel.

The sample aliquots were eluted with 90 mL of hexane. The eluates were collected and reduced to less than 1 mL in a rotary evaporator. The concentrated eluates were then transferred to mini-columns consisting of a 10-mL disposable pipette plugged with silanized glass wool and packed with 1 g of Woelm basic alumina (activated at 600 ^{o}C for 24 hours).

The sample extracts were transferred to the top of the mini-column and eluted with 5 mL of 3% (v/v) methylene chloride in hexane (discarded), followed by 20 mL of 50% (v/v) methylene chloride in hexane. The 50% eluate was collected and reduced to less than 1 mL in a rotary evaporator.

The concentrated eluates were transferred to mini-columns consisting of a 10-mL disposable pipette plugged with silanized glass wool and packed with 2 cm of an 18% Carbopack C on Celite 545 mixture. This column was preeluted with 20 mL of toluene followed by 1 mL of 75:20:5 methylene chloride/methanol/benzene, 1 mL of 1:1 cyclohexane in methylene chloride, and 2 mL of hexane. The extract was then added to the column and sequentially eluted with two 1-mL aliquots of hexane, 1 mL of 1:1 cyclohexane in methylene chloride, and 1 mL of 75:20:5 methylene chloride/ methanol/benzene. The PCDD/PCDF fraction was then collected by elution with 2 mL of toluene.

The retained eluates (PCDD/PCDF fraction) were concentrated to near dryness and brought to a final volume of 20 uL with isooctane for analysis.

Instrument Conditions

The cleaned extracts were analyzed and data acquired on an HP 5970 quadrupole gas chromatograph/mass selective detector (GC/MSD) operating in the selected ion monitoring (SIM) mode. The instrument parameters are listed below.

Column:	Hewlett Packard 30 m SE-54
Carrier Gas:	He @ 5 psi Head Pressure
GC:	HP 5890
Mode:	SIM Electron Impact
Injection Port Temperature:	300 ^{o}C
Splitless Time:	0.75 min
GC Program:	100 to 300 @ 20 ^{o}C/min
Hold:	300 ^{o}C
Electron Multiplier:	3,000 V
Emission Current:	300 mA
Injection Volume:	2 uL splitless

At least three ions were monitored for each congener group. One ion was also monitored for the chlorinated diphenyl ethers which are interferences for the PCDFs in this analysis. Table I lists the ions monitored and the group switch points for the different congener groups.

Linearity

Linearity for the congener groups was determined by injecting a set of calibration standards at the 10-, 50-, 100-, 250-, and 500-picograms per microliter (pg/uL) levels of the native isomer. Response factors (RF) for each compound in the standard mixtures were calculated using the following formula:

$$\frac{(\text{Area Ion I} + \text{Area Ion II}) \times \text{Amt Labeled Std Ion}}{\text{Area Std Ion I} + \text{Area Std Ion II}) \times \text{Amt Native Std}} = \text{RF}$$

An average response factor for the compound was calculated from the five-level linearity set.

Table I
Masses and Windows for the Determination
of PCDDs and PCDFs

Compound	Mass 1	Mass 2	Mass 3	Ratio M1/M2	Window Start/Stop (min)
Tetrachlorodibenzodioxin	320	322	259	0.77	10/13.3
Tetrachlorodibenzofuran	304	306	241	0.77	10/13.3
^{13}C-tetrachlorodibenzodioxin	332	334	---	0.77	10/13.3
^{37}Cl-tetrachlorodibenzodioxin	328	---	---	---	10/13.3
^{13}C-pentachlorodibenzodioxin	368	370	---	1.54	13.3/15.6
Pentachlorodibenzodioxin	356	358	293	1.54	13.3/15.6
Pentachlorodibenzofuran	340	342	275	1.54	13.3/15.6
^{13}C-hexachlorodibenzodioxin	402	404	---	1.23	15.6/18
Hexachlorodibenzodioxin	390	392	327	1.23	15.6/18
Hexachlorodibenzofuran	374	376	311	1.23	15.6/18
^{13}C-heptachlorodibenzodioxin	436	438	---	1.03	18/23
Heptachlorodibenzodioxin	424	426	361	1.03	18/23
Heptachlorodibenzofuran	408	410	345	1.03	18/23
^{13}C-octachlorodibenzodioxin	470	472	---	0.88	23/26
Octachlorodibenzodioxin	458	460	395	0.88	23/26
Octachlorodibenzofuran	442	444	379	0.88	23/26

CANONIE ENVIRONMENTAL SERVICES
Clayton Project No. 48641-17

Compound Identification Criteria

In order for a compound to be reported, it must pass the following criteria:

(1) All ions measured must be present and maximize within 2 seconds of each other.

(2) Measured isotopic abundance ratios must be within ± 15% of the theoretical ratio.

(3) The signal to noise ratio of the corresponding standard must be greater than 5 to 1.

Detection Limits

In cases where no congeners were detected, detection limits were calculated using one of the following methods:

- When no peaks were detected in the window at either ion:

$$\frac{(\text{RMS Ion I} + \text{RMS Ion II}) \times 2.5 \times \text{Amt Std(ng)}}{\text{HSTD Ion I} + \text{HSTD Ion II}) \times \text{RRF (avg)}} = \text{Detection Limit (ng)}$$

Where:

RMS Ion I = root mean square noise average for interval around Ion I
Amt Std(ng) = nanogram of added internal standard
HSTD Ion I = height of peak for standard Ion I
RRF(avg) = average response factor for congener group

- When no peaks were detected in the window for one ion and interferences were present in the window of the second ion:

$$\frac{(\text{RMSW}) \times 2.5 \times \text{Amt Std (ng)}}{(\text{HSTD Ion I} + \text{HSTD Ion II}) \times \text{RRFW}} = \text{Detection Limit (ng)}$$

Where:

RMSW = RMS noise in ion interval for ion without interference
RRFW = Single ion response factor for ion without interference

- Where coeluting peaks were detected in both ion windows that did not match correct abundance ratios:

$$\frac{\text{Area S} \times \text{Amt Std(ng)}}{(\text{Area STD Ion I} + \text{Area STD Ion II}) \times \text{RRFS}} = \text{Detection Limit (ng)}$$

Where:

Area S = area of smaller ion with interference
RRFS = single ion response factor

- Where coeluting peaks were detected in both ion windows that did not match correct abundance ratios:

$$\frac{\text{Area S x Amt Std(ng)}}{\text{(Area STD Ion I + Area STD Ion II) x RRFS}} = \text{Detection Limit (ng)}$$

Where:

Area S = area of smaller ion with interference
RRFS = single ion response factor

Calculation Methods

When coeluting peaks exhibited the correct isotope abundance ratio, the amount in the sample was calculated using the following formula:

$$\frac{\text{(Area Ion I + Area Ion II) x Amt Std (ng)}}{\text{(Area Std Ion I + Area Std Ion II) x Avg RRF}} = \text{Amt (ng)}$$

Surrogate amounts were calculated using the following formula which corrects for the contribution to mass 328 of any native 2,3,7,8-TCDD:

$$\frac{\text{(Area 328 - 0.009 x Area 322) x Amt Std(ng)}}{\text{(Area 332 + Area 334) x RRF } ^{37}\text{Cl 2,3,7,8-TCDD}} = \text{Amt(ng)}^{37}\text{Cl-TCDD}$$

Quality Control

A matrix spike sample was analyzed with the batch of samples. These results and the surrogate recovery results are presented in Tables II and III. The results for the blanks are presented in Table IV.

CANONIE ENVIRONMENTAL SERVICES
Clayton Project No. 48641-17

Table II
Matrix Spike Results

Compound	Recovery (%)
2,3,7,8-tetrachlorodibenzo-p-dioxin	99
Total tetrachlorodibenzodioxins	99
2,3,7,8-tetrachlorodibenzofuran	82
Total tetrachlorodibenzofurans	96
Total pentachlorodibenzodioxins	91
Total pentachlorodibenzofurans	90
Total hexachlorodibenzodioxins	110
Total hexachlorodibenzofurans	56
Total heptachlorodibenzodioxin	96
Total heptachlorodibenzofurans	96
Octachlorodibenzodioxin	ND
Octachlorodibenzofuran	74

ND = Compound not detected in spike.

CANONIE ENVIRONMENTAL SERVICES
Clayton Project No. 48641-17

Table III
Surrogate Recoveries

Lab Number	Sample Description	^{37}Cl-TCDD (%)
631669	Composite 88-0279-40 88-0279-44	84
631670	Composite 88-0279-41 88-0279-42 88-0279-45	92
631672	Composite 88-0279-43 Blank 88-0279-46	78
--	Matrix Spike	69
--	Lab Blank 1	76
--	Lab Blank 2	83

CANONIE ENVIRONMENTAL SERVICES
Clayton Project No. 48641-17

Table IV
Blank Results

Compound	Lab Blank 1 Sorbent (ng)	Lab Blank 2 Liquid (ng)
2,3,7,8-tetrachlorodibenzo-p-dioxin	<0.59	<0.53
Total tetrachlorodibenzodioxins	<0.59	<0.53
2,3,7,8-tetrachlorodibenzofuran	<0.32	<0.31
Total tetrachlorodibenzofurans	<0.32	<0.31
Total pentachlorodibenzodioxins	<1.1	<1.1
Total pentachlorodibenzofurans	<0.93	<0.71
Total hexachlorodibenzodioxins	<1.1	<1.6
Total hexachlorodibenzofurans	<0.44	<0.67
Total heptachlorodibenzodioxin	<2.4	<2.9
Total heptachlorodibenzofurans	<1.1	<1.5
Octachlorodibenzodioxin	<12	<16
Octachlorodibenzofuran	<5.5	<6.9

TEST 1

FLUE GAS RESULTS
FURANS AND DIOXINS
CHEMEX LABS ALBERTA, INC.

CHEMEX

Labs Alberta Inc.

UMATAC Industrial Processes

Attention: W. Taciuk

Furan and Dioxin Analysis of Stack Gas collected on XAD²

Since Chemex Labs Alberta Inc. does not have the facilities to handle furan or dioxin standards, only a qualitative assessment of the presence of these compounds was attempted. In order to perform this assessment, the extraction procedure as outlined in EPA Method 8280 was carried out. The solvent elution known to contain any dioxin or furan compound was then injected into a Hewlitt Packard GC/MSN with the following conditions:

GC Parameters,

Initial Temp:	170°C
Initial Hold:	10 min
Ramp Rate:	8°C min-1
Final Temp:	320°C
Final Hold:	20 min

MS Parameters,

Mass range: 35.0 - 450 Amu
Peak threshold: 1500

...continued

CALGARY 2021 - 41 Avenue N.E., Calgary, Canada T2E 6P8 Tel.: (403) 291-3577 Fax: (403) 291-9468
EDMONTON 9331 - 48 Street, Edmonton, Canada T6B 2R4 Tel.: (403) 466-2677 Fax: (403) 466-3339
GRANDE PRAIRIE 8105, 8902 - 112th Street, Grande Prairie, Canada T8V 6X4 Tel.: (403) 532-0227
RAINBOW LAKE c/o General Delivery, Rainbow Lake, Canada T0H 2Y0 Tel.: (403) 956-3161
Banff Avenue & Highway 58 [illegible]

...2

..

The compounds monitored and their corresponding mass ion ratios were as follows:

Compound	Quantitation Ion and Confirmation Ions
DIOXIN	
TCDD	322,320,257
PCDD	356,354,358 293
HxCDD	390,388,392,327
HpCDD	424,422,426,361
OCDD	460,458,395
FURANS	
TCDF	306,304,243
PCDF	340,338,342,277
HxDF	374,372,376,311
HpDF	408,406,410,345
OCDD	444,442,379

There was no indication of the presence of any of the mass ions associated with the compounds investigated.

If the assumption is made that the GC/MSD responds the same as the GC/MS used to develop EPA 8280, then the detection limits may be assumed approximately as follows: Based on 233 litres of gas;

TCDD - 0.25 ng/cu^{1}

TCDF - 0.06 ng/cu^{1}

TEST 1

FLUE GAS RESULTS
POLYCHLORINATED BIPHENYLS
CLAYTON ENVIRONMENTAL CONSULTING, INC.

CANONIE ENVIRONMENTAL
Clayton Project No.: 48641-17

Table 2

Lab Number	Sample Description	Polychlorinated Biphenyls Aroclor 1242 (ug)	Aroclor 1254 (ug)
631669	88-0279-40 88-0279-44	100.000	<1
631670	88-0279-41 88-0279-42 88-0279-45	20.000	<1
631672	88-0279-43 88-0279-46	<1	<1
Limit of Detection:		1 ug	1 ug
Analytical Method:		EPA 608	EPA 608

The remaining results will be forwarded upon completion.

It is a pleasure to be of assistance to you. Please contact me at (313) 344-1770 if you have any questions.

Robert Lieckfield Jr., C.I.H.
Manager, Laboratory Services
Novi Office

TEST 2

PRELIMINARY FLUE GAS RESULTS
POLYCHLORINATED BIPHENYLS
CLAYTON ENVIRONMENTAL CONSULTANTS, INC.

CANONIE ENVIRONMENTAL PRELIMINARY RESULTS FOR PCBS
(RESULTS ARE VERBAL)

Client Description	#2,4,5 Composite	#3 (XAD)	UMATAC Filter Blank	UMATAC 12/05/88 (Filter)	H_2O Blank MeOH/MeCl2 Blank
Clayton Lab No.	640318 640319 640320 Composite	640321	640322	640323	640579 640580 Composite
PCBs	22 mg/l 1242	2.5 mg/g 1242	<20 ug/gm 1248	80 ug/gm 1248	<0.08 mg/l 1242

TEST 2

PRELIMINARY FLUE GAS RESULTS
FURANS AND DIOXINS
CLAYTON ENVIRONMENTAL CONSULTANTS, INC.

Canonie Env Dioxin Preliminary Results 6/14/88

49473-17

Client Description	#3,4,5 Composite	#3	IMPACT FILTER BLANK	IMPACT 12/05/88	H_2O BLANK MeOH/MeCl$_2$ BLANK
Clayton Lab #	640318 640319 640320 composite	640321	640322	640323	640579 640580 composite
	(ng/mL)	(ng/gm)	(ng/gm)	(ng/gm)	(ng/mL)
2,3,7,8-Tetrachlorodibenzo(p)dioxin	<0.0023	<11	<5.5	<2.3	<0.0042
Total Tetrachlorodioxins	<0.0023	<11	<5.5	<2.3	<0.0042
2,3,7,8-Tetrachlorodibenzo(p)furan	0.19	21	<2.8	79	<0.0018
Total Tetrachlorofurans	1.4	690	<2.8	520	<0.0018
Total Pentachlorodioxins	<0.0014	<2.4	<9.7	<2.4	<0.0066
Total Pentachlorofurans	<0.078	<3.0	<6.0	37	<0.0057
Total Hexachlorodioxins	<0.0010	<2.1	<7.4	<1.2	<0.0050
Total Hexachlorofurans	<0.00052	<0.89	<4.5	<0.62	<0.0030
Total Heptachlorodioxins	<0.0018	<0.82	<10	<1.1	<0.0059
Total Heptachlorofurans	<0.0019	<1.2	<7.7	<0.87	<0.0040
Total Octachlorodioxins	<0.0071	<0.84	<39	<4.2	<0.024
Total Octachlorofurans	<0.0046	<0.40	<18	<2.1	<0.012

IMPINGEMENT LIQUIDS 450 ml

XAD 11.68 gm

FILTER 0.14 gm

VOLUME FLUE GAS = 160 S.C.F.

TRADE SECRET

APPENDIX D

RESULTS OF PERSONNEL MONITORING

APPENDIX
D

TEST 1

PERSONNEL MONITORING RESULTS
POLYCHLORINATED BIPHENYLS
CLAYTON ENVIRONMENTAL CONSULTANTS, INC.

TRADE SECRET

CLAYTON ENVIRONMENT CONSULTANTS, INC.

Analytical Laboratory Report

Ms. Irene Fanelli
Health & Safety
CANONIE ENVIRONMENTAL
1825 South Grant Street, Suite 260
San Mateo, CA 94402

Date Reported: 16-MAY-88
Date Received: 28-APR-88
Clayton Project No.: 48641-17
Partial Report

Dear Ms. Fanelli:

The following is our report on the samples submitted for analysis.

RECEIVED
MAY 20 1988
Ans'd.....

Table 1

Polychlorinated Biphenyls

Lab Number	Sample Description	Air Volume (liters)	Aroclor 1242 Tube (ug)	Aroclor 1242 Tube (ug/m3)	Aroclor 1242 Filter (ug)	Aroclor 1242 Filter (ug/m3)	Aroclor 1254 Tube (ug)	Aroclor 1254 Tube (ug/m3)	Aroclor 1254 Filter (ug)	Aroclor 1254 Filter (ug/m3)
631660	ISF418 1A & B	152	<0.07	<0.5	<0.7	<5	<0.07	<0.5	<0.2	<1
631661	ISF418 2A & B	172	<0.07	<0.4	<0.2	<1	<0.07	<0.4	<0.2	<1
631662	ISF418 3A & B	170	<0.07	<0.4	<0.2	<1	<0.07	<0.4	<0.2	<1
631663	ISF418 4A & B	148	<0.07	<0.5	<0.2	<1	<0.07	<0.5	<0.2	<1
631664	BLANK	--	<0.07	--	<0.2	--	<0.07	--	<0.2	--
631665	ISF 419 1A & B	--93	<0.07	--<0.8	<0.2	--<2	<0.07	--	<0.2	--
631666	ISF 419 2A & B	--93	<0.07	--<0.8	<0.2	--<2	<0.07	--	<0.2	--
631667	ISF 419 3A & B	--102	<0.07	--<0.7	<0.2	--<2	<0.07	--	<0.2	--
631668	ISF 419 4A & B	--93	<0.07	--<0.8	<0.2	--<2	<0.07	--	<0.2	--
	Limit of Detection:		0.07 ug		0.2 ug		0.07 ug		0.2 ug	
	Analytical Method (NIOSH):		5503		5503		5503		5503	

TRADE SECRET

APPENDIX
E

APPENDIX E

CHAIN-OF-CUSTODY RECORDS FOR SAMPLES

TRADE SECRET

TEST 1

CHAIN-OF-CUSTODY RECORDS

SAMPLE CUSTODY SHEET
UMATAC PCB RUN

Sample Description : Filter from MM5 train

Identification Number : ✓ 88-0270-40

Date : April 19/88
Time : 16 20 - 18 20

Sampled By : W Book

Received By : N Moffat

SUBSEQUENT ANALYSIS

Date and Time	In Custody of	Purpose

52

F1/BK
1/Am

TRADE SECRET

SAMPLE CUSTODY SHEET
UMATAC PCB RUN

Sample Description : CONTAINER # 4 CONDENSATE
MMS train

Identification Number : J (88-0279-41)

Date : April 19/88
Time : 16:20 - 18:20

Sampled By : W Bock

Received By : [signature]

SUBSEQUENT ANALYSIS

(62)

Date and Time	In Custody of	Purpose

45641-17 NH

TRADE SECRET

SAMPLE CUSTODY SHEET
UMATAC PCB RUN

Sample Description : CONTAINER #2 Front Wash MM5 train

Identification Number : ✓ 88-0279-42

Date : April 19/88

Time : 16:20 - 18:20

Sampled By : W. Book

Received By : N Moffat

SUBSEQUENT ANALYSIS

Date and Time	In Custody of	Purpose

30

0703

45644 (NJ)

TRADE SECRET

SAMPLE CUSTODY SHEET
UMATAC PCB RUN

Sample Description : Methanol, Methylene Chloride Blank MM5 train.

Identification Number : ✓ 88-0279-43

Date :

Time :

Sampled By : W. Baak.

Received By : N Moffat

SUBSEQUENT ANALYSIS

Date and Time	In Custody of	Purpose

30

4564-

TRADE SECRET

SAMPLE CUSTODY SHEET
UMATAC PCB RUN

Sample Description : CONTAINER #3 XAD 2 Resin mm5 train

Identification Number : J 88-0279-44

Date : April 19/88

Time : 16:20 - 18:20

Sampled By : W Book

Received By : N Moffat

SUBSEQUENT ANALYSIS

Date and Time	In Custody of	Purpose

(39)

ASSIGNED TRADE SECRET

SAMPLE CUSTODY SHEET
UMATAC PCB RUN

Sample Description : CONTAINER # 5 Back Rinse
MM 5 train

Identification Number : ✓ 88-0279-45

Date : April 19/88
Time : 16:20 - 18:20

Sampled By : W Book.

Received By : [signature]

SUBSEQUENT ANALYSIS

Date and Time	In Custody of	Purpose

(30)

4154-TM

TRADE SECRET

SAMPLE CUSTODY SHEET
UMATAC PCB RUN

Sample Description : Distilled Water Blank

Identification Number : ✓ 88-0279-46

Date : April 19/88
Time : 16:20 - 18:20

Sampled By : W. Book

Received By : M. Nutt

SUBSEQUENT ANALYSIS

Date and Time	In Custody of	Purpose

30

TRADE SECRET

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.

Request for Industrial Hygiene Analytical Laboratory Services

Name: Irene Farelli Title: Lab. Safety

Company: Cantrie Environmental Services

Street: 1125 S Grand St Ste 760

City: San Mateo State: CA Zip: 94402 Phone: (415) 573 2012

Client P.O. Number: (will call with #) Prepared by:

Sampling date: 4/18-19/88 Sampling media: glass fiber filter / PUF cartridge

Results required by: normal TA

	Sample Description	Air Volume (give units)	Analyses Requested
1	ISF 418.1A & B	152 liters	DIOXINS
2	ISF 418.2A & B	172	
3	ISF 418.3A & B	170	
4	ISF 418 4A & B	148	
5	BLANK filter	—	
6	BLANK tube	—	
7	ISF 419.1A & B		
8	ISF 419.2A & B		
9	ISF 419.3A & B		
10	ISF 419.4A & B		
11			
12			

79

Special Instructions:

filter and tube result may be reported together

Please return a copy of the lab request with the analytical results

SAMPLES IN WALK-IN FRIDGE - IN A BLUE COOLER

Please return to:

Clayton Environmental Consultants, Inc.
22345 Roethel Drive
Novi, MI 48050
(313) 344-1770

Attn: Laboratory

01/27/88

LAB USE ONLY

Date Received:

Project Number: 4864I-17 NIP

Initials: C.R.

TRADE SECRET

TEST 2

CHAIN-OF-CUSTODY RECORDS

MAY 26 1988

CANONIE ENVIRONMENTAL

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.

Request for Industrial Hygiene Analytical Laboratory Services

Name PETER REMICK Title PROJECT ENGINEER

Company CANNONIE ENVIRONMENTAL SERVICES CORP.

Street 600 CANNONIE DRIVE

City PORTER State IN Zip 46304 Phone (219) 926-6651

Client P.O. Number _____ Prepared by PETER REMICK

Sampling date 5/12/88 Sampling media _____

Results required by ONE WEEK TURNAROUND

	Sample Description	Air Volume (give units)	Analyses Requested
1	PCB OIL FEED COMPOSITE		PCBs, DIOXINS, BENZOFURANS
2	KILN END LEAKAGE COMPOSITE		PCBs
3	SCRUBBER LIQUID COMPOSITE		PCBs
4	BAGHOUSE FINES COMPOSITE		PCBs
5	FLUE GAS CYCLONE FINES COMPOSITE		PCBs
	KILN HEAD OIL COMPOSITE		PCB
	TAILINGS DISCHARGE COMPOSITE		PCB, DIOXINS, BENZOFURANS
8	SILT WATER COMPOSITE		PCB
9	BENCH SOIL/SIDE DRAW OIL COMPOSITE		PCB
10	M.C. Cyclone Fines COMPOSITE		PCB
11	LAB PREP SAND FEED COMPOSITE		PCB, DIOXINS, BENZOFURANS
12			

Special Instructions:

PLEASE MAKE COPY OF THIS SHEET & PETER REMICK WITH THE "LAB USE ONLY" SECTION IS COMPLETED.

Please return to:

Clayton Environmental Consultants, Inc.
22345 Roethel Drive
[illegible], MI 48050
[illegible] 344-1770

Attn: Laboratory

5/11/88

LAB USE ONLY

Date Received RECEIVED

Project Number 49208-NCR

Initials _____

TRADE SECRET

LABORATORY REQUEST FORM

Name: Susan Walter

Company: Canonie Environmental

Street: 9A Environs Office East

City: Englewood State: CO Zip: 80112

Phone Number: (303) 790-1747 P.O. No.: 88-058

Sampling Date: 5/12/88 Sampling Media: Florisil with Glass fiber filter

	Sample Description:	Air Volume:	Analyses Requested:
1.	242/51288 (A) (B)	32 L	PCB 1001
2.	698/51288 (A) (B)	40 L	PCB
3.	245/51288 (A) (B)	36 L	PCB
4.	356/51288 (A) B	40 L	PCB
5.	[redacted] BLANK		
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			

Special Instruction (method, limits of detection): Please provide sample collection information below and return copy with sample results.

Signature: Susan Walter Date: 5/26/88

FOR LAB USE ONLY
Due Date:
Misc:

FOR LAB USE ONLY
Date Received: [illegible] MAY 27 88
Job No. 49242-17
Log-in-date:

TRADE SECRET

CHEMEX Labs Alberta (1984) Ltd.

DANGEROUS GOODS SHIPPING BILL

00685

SENT BY:

CONSIGNOR	CONSIGNEE	CARRIER ☑ TRUCK ☐ RAIL ☐ SHIP — ☐ SPECIAL COMMODITY
NAME [illegible] (0001)	NAME CLAYTON LABS	COMPANY NAME LOOMIS
ADDRESS 2021 - 41 [illegible] N.E.	ADDRESS 960 HURON CHURCH ROAD	ADDRESS
CITY, PROV. [illegible] POSTAL CODE [illegible]	CITY, PROV. WINDSOR ONT POSTAL CODE N9C 2Y9	CITY, PROV. POSTAL CODE
SHIPPER'S AUTHORIZATION PAT DOWN	DATE RECEIVED	GENERAL OR OWNER UNIT NO. OF TRANSPORT UNIT
SHIPPER'S SIGNATURE PAT DOWN DATE SHIPPED	RECEIVED BY	NAME OF DRIVER

(703) SHIPPING NAME AND DESCRIPTION	PRIMARY CLASSIFICATION	SUB-CLASS	P.I.N. UN or NA	DESIGNATE E - EXPLOSIVE I - INFECTIOUS	PACKING GROUP	IF TRANSFERRED IN BULK GIVE FLASH POINT	REFERENCE #	TELEPHONE #	BASIS or VOLUME	# OF PKGS.
30 METHYLENE CHLORIDE		9.2	1593	I	III				100ml	1
2 #2 ✓ DIST. H2O BLANK										
#3 ✓ MEOH MECL BLANK										
#4										
#5 (52) ✓ UMATAC Filter BLANK										
30 (401) ✓ UMATAC 12/05/88										

SPECIAL INSTRUCTIONS (i.e. CONTROL AND EMERGENCY TEMPERATURES, ANY REQUIREMENTS TO ENSURE STABILITY) ☐ ADDITIONAL DOCUMENTS ATTACHED

BOL NO.

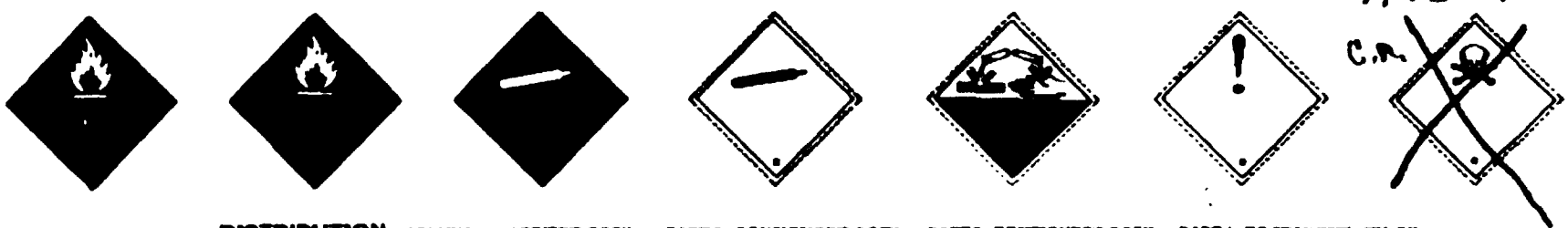
24 HOUR EMERGENCY TELEPHONE NUMBER	PROTECTIVE DIRECTION NUMBER	EQUIVALENT LEVEL OF SAFETY PERMIT NUMBER	PERMIT FOR EXCEPTION NUMBER

PLACARDS REQUIRED (PLEASE INDICATE BY CROSSING OUT APPROPRIATE PLACARDS i.e. ⊗) ☐ LAST CONTAINED AS ABOVE

RECEIVED JUN 0 3 1988

49473-17

C.R.



DISTRIBUTION: ORIGINAL - CARRIER'S COPY PART 2 - CONSIGNOR'S COPY PART 3 - CONSIGNEE'S COPY PART 4 - TO STAY WITH TRUCK

TRADE SECRET